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EXTRACTS FROM KANG-T'IEH (STEEL)

ISSUE NUMBER 10

- COMMUNIST CHINA -

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CONTENTS

"HSIAO-YANG-CHUN" PROMOTED STEEL INDUSTRY'S GREAT LEAP FORWARD

[Following is a translation of extracts from an article written by Wang Hao-shou, Ministry of Metallurgical Industry, Kang-t'ieh (Steel), Peiping, No. 10, 27 May 1960, pages 569-572.]

During the First Five-Year Plan, China's steel output increased from 1,350,000 [metric] tons to 5,350,000 tons, an average annual increase of 800,000 tons. The annual rate of increase was 31.7%.

In 1958 and 1959, steel not only had an absolute annual average increase of about 4 million tons, but it also had an annual average increase rate of over 60%.

Calculating on the basis of the total national steel output in 1959, medium and small blast furnaces produced more than one half of the pig iron, while the medium and small converters produced more than one third of the steel. "Hsiao-tu-chun" [small native group] and "hsiao-yang-chun" [small foreign group] produced one-half of the ingots and two-thirds of the coke. It is obvious that the "hsiao-yang-chun" has become a new force, which is a very important force in the rapid development of the steel industry's great leap forward.

China's steel industry has made great achievements in its great leap forward in the last two years. But its current annual output of only some 10,000,000 tons is far from meeting the needs of the rapid development of the national economy.

Judging from present conditions, the following measures must be urgently promoted:

1. Although the "hsiao-yang-chun" is still struggling for technical reforms and technical revolution, its techniques have many defects. This struggle must be

continued and the movement must be strengthened by Party guidance to enable the "hsiao-yang-chun" to make further developments so that it will become the vanguard in the steel industry's technical revolution.

2. Of the thousands of "hsiao-yang-chun", select some of the best qualified, promote them, and enlarged them so that they will become medium-size and small-size steel and iron combined enterprises; lead their development toward comprehensive operation. For instance, a small steel plant may produce structural materials and chemical products, and engage in mining.

3. In many provinces and autonomous regions, there are very few steel "hsiao-yang-chun" organizations. In the next few years, a mass movement for the organization of more "hsiao-tu-chun" and "hsiao-yang-chun" must be continuously promoted.

4. The technical reforms of these two groups must be promoted step by step. Their difficulties in mining and transportation must be solved. At the same time, the masses must be around to promote a contest between these two groups for greater advancement.

Under the glories of the ideas of Mao Tse-tung, the flag of "hsiao-yang-chun" becomes more glorious. For greater victories, there must be a continuous revolution and leap forward.

BIG DROP IN PIG IRON CONSUMPTION FOR CONVERTER STEEL PRODUCTION

[Following is a translation of extracts from a report made by Ma Ch'eng-te, Department of Steel Production Techniques, Ministry of Metallurgical Industry, to the Technical Committee of the National Converter Steel Production Conference, held on 31 March 1960, Kang-t'ieh (Steel), Peiping, No. 10, 27 May 1960, pages 577-578.]

Big Drop in Pig Iron Consumption for Converter Steel Production Is the Fulfillment of One of Converter Steel Production Tasks in 1960. It Points Out the Great Potential of the Drop in Pig Iron Consumption. Using Air to Revolutionize Steel Production Techniques, the Task in Reducing Pig Iron Consumption Will Be Accomplished.

The big drop in pig iron consumption for converter steel production is a struggle for an all-out great leap forward in converter steel production in 1960 and is one of the important tasks in fulfilling converter steel production.

In 1959, small balst furnaces acheived great developments. This year, the rate of pig iron production in small balst furnaces through out the nation that has met the required standards reached 75%, and there is pig iron from Anhwei and three other provinces that passed the 90% rate. This rise in pig iron quality provides converter steel production with better raw materials.

Even under the present raw material conditions, the reduced pig iron consumption in converter production

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Even under the present raw material conditions, the reduced pig iron consumption in converter production

still has a great potentiality. According to the actual pig iron consumption in all production enterprises in 1960, the difference between the advanced enterprises and the backward ones is very great.

This year, enterprises in Tsingtao, T'ang-shan and Shanghai have lowered their pig iron consumption to below 1,200 kilograms/ton. In Tsingtao, it was even lowered to 600-700 kilograms (excluding scrap steel). These facts show that there are great possibilities for a big drop in pig iron consumption. It is entirely possible for the average pig iron consumption for the whole year to be lowered to 1,200 kilograms.

From last winter to this spring, because the introduction of heated blasts of air revolutionized the technique of steel production, pig iron consumption has shown a revolutionary change. For instance, the Tientsin No 3 and the Ta-yeh Steel Plants, in January, have lowered their pig iron consumption, as compared to that of last year, by 236-287 kilograms/ton. Especially, the Tsingtao and T'ang-shan plants have a per unit monthly average consumption of 1,200 kilograms/ton. These are good examples of reduced pig iron consumption.

There are many more including: In January,707 kilograms/ton in the Shanghai Machine Repair Plant; 950 kilograms/ton in the Anshan Steel Western Machine Repair Plant; 1,037 kilograms/ton in the Anshan Steel Southern Machine Repair Plant; 1,221 kilograms/ton in the Tientsin Steel Plant No 3; and 1,238 kilograms/ton in the Ma-an-shan Steel Plant. In February, 1,204 kilograms/ton in the T'ang-shan Steel Plant; and 1,165 kilograms/ton in the Tsingtao Sheng-yen Machinery Plant.

The improved method of casting ingots, the reduction and elimination of scrap steel are important means of saving pig iron.

The experiences gained by the T'ang-shan Steel Plant in cleaning the molds for steel ingots and the Tientsin Steel Plant No 3 in using circulating mold cars, have reduced the original consumption of pig iron 30-40 kilograms per ton, and lowered it to 4-10 kilograms. This is a great saving in pig iron.

SURPASS THE OPEN-HEARTH FURNACE, CATCH UP WITH THE ELECTRIC FURNACE AND STRUGGLE FOR HIGH QUALITY AND VARIETIES OF PRODUCTS IN CONVERTER STEEL PRODUCTION

[Following is a translation of extracts from a report made by Yu Ching-sheng, Department of Steel Production Techniques, Ministry of Metallurgical Industry, to the Technical Committee of the National Converter Steel Production Conference, held on 31 March 1960, Kang-t'ieh (Steel) Peiping, No. 10, 27 May 1960, pages 579-582.]

Converter Steel Production Can Attain High Quality, Varieties of Products, and Surpass the Open-Hearth Furnace and Catch Up with the Electric Furnace.

The side-blown basic converter has ability similar to the open-hearth furnace or the electric furnace in achieving high quality and varieties of products, but there are some people who still doubt its quality. This is because they are accustomed to the quality of bottom-blown converter steel. On the basis of this opinion, they are prejudiced against side-blown basic converter steel and, therefore, have set up many restrictions against its use; such as certain metals cannot be used to make parts for machines that vibrate considerably, are used in very cold climates, or are to be welded together. As a matter of fact, the side-blown basic converter is a new process in steel production, and it is different from the bottom-blown basic converter.

As early as 1958, China used the side-blown basic converter to produce common carbon steel (No 2-5), small blister steel, and many varieties of welding steel (CB08 [SV08], CB08 [SV08] blister, CB08A [SV08A], CB10r2 [SV10G2], CB10rc [SV10Gs], CB15rcB [SV15GsV], 08rA [08GA],

CB10rcM [SV$_{10}$ GsM]), and low alloy high strength steel (25SiMn, 16 SiMn); there were 20 varieties of steel. There were also seamless steel pipes, steel rails, and large-size block steel.

In the different parts of the country, electric machine silicon steel, compressed utensil silicon steel, spring steel, bridge steel, ship-building steel plates, boiler steel plates, high-carbon tool steel, steel wire cables, alloy seamless steel pipes were produced. Steel was even compounded with Ti, Mo, V, Al, B, Cu, Cr, low alloy high strength steel, and low alloy compound steel (such as 40Cr, 20Mn2B, 20MnMoB). Furthermore, there were attempts to produce 40Cr9Si2 high alloy heat-resistant stainless steel.

Now, the various converter steel plants are producing 117 varieties of steel. There are many varieties that are now in the trial production stage, and the ratio of their chemical elements meets the required standards. According to past experiences, all these trials will be successful.

Combined converter-electric furnace steel production is based on the slag bath principle, which China created. It can raise the quality of converter steel to that of electric furnace steel, and can increase electric furnace steel production from two to more than ten times.

Because of the counteracting effect in this combined steel production, steel and slag are vigorously stirred together, to change the slag into small particles; thus, the area of contact between steel and the slag particles has increased from many thousand to hundreds of thousands of times and the rate of deoxidization and desulfurization reaction and that of the slag particle's deoxidization and desulfurization have also greatly increased. The melt from the electric furnace requires 45 to 90 minutes to solidify, but with the combined process, only several minutes are required. Within this very short time, the rate of desulfurization is 51% and that of deoxidization is 70.4%.

Facts have proved that in the combined converter-electric furnace process, the amount of oxygen and sulfur in steel is greatly reduced.

The mechanical properties of the combined converter-electric furnace steel can reach an equal level with that of electric furnace steel. This is shown in the following table:

Steel Variety	Mechanical Properties				
	Bkg/mm	T,kg/cm	%	%	K,kg-m/cm^2
40Cr	(100)	(80)	(8)	(40)	(5.4)
40Cr	108.3	97.7	14.2	47.4	6.71
40Cr	107.3	95.6	14.5	51.0	6.98
35CrMo	(95)	(80)	(10)	(40)	16.3
35CrMo	103.4	91.9	15.7	56.6	12.7
35CrMo	106.9	93.9	13.6	49.7	10.5
35SiMn	(85)	(65)	(15)	(40)	(6)
35SiMn	91.1	75.7	18.9	52.5	10
45	(60)	(34)	(10)	(40)	-
45	66.2	42.5	23.7	46.4	-

Note: In the above table, the figures in ( ) are standards stipulated by the Ministry.

At present, the Ta-yeh, Ta-lien, Chung-king, and Peiping Steel Plants, in using the combined steel production process, have successfully produced the following varieties of steel: No. 20-55 superior quality carbon steel, carbonized tool steel, 20Cr, 40Cr, 35SiMn, 30CrMnSiA, 35CrMo, 40CrSi low alloy compound steel, GCr9 bearing shaft steel, 55Si2Mn spring steel, and 20 other kinds of steel; the quality and mechanical properties of the steel are generally equal to electric furnace steel. From present statistics, it can be predicted that the combined steel production process will be able to produce the varieties of steel that are now produced by the electric furnace process.

Deputy Minister Liu Pin stipulated in his report, the following requirements for converter steel production:

1. This year's requirement is to take possession of all steel varieties produced by open-hearth furnaces throughout the country. It is also required that key enterprises should lead and assist the medium-sized enterprises in the provinces and cities to produce a great part or a portion of the open-hearth furnace steel varieties.

2. The combined converter-electric furnace steel production process must be greatly developed. Steel

varieties must surpass open-hearth furnace varieties and catch up with those of electric furnaces. Especially, it should be developed so that no nickel and chromium are needed for the new alloy steel variety.

In accordance with Deputy Minister Liu Pin's instructions and under the demands of the present conditions and the coordination of long-range development, the following recommendations are made in order to shape a practical plan for this year's steel production:

A. First, it must guarantee the completion of ten varieties of steel. These are: heavy rails, medium rails, medium steel plates, thin steel plates, steel-wire cables, seamless steel pipes, large steel blocks, silicon steel plates, welding steel pipes, and superior quality steel. At the same time, each plant must satisfy local demands for steel. With the hope of coordinating the conditions in the rolling mills, great efforts must be exerted to satisfy their demands. The policy is what the rolling mills want, the steel plants must make.

1) Those plants that have rolling mills and pipe-welding equipment but rely on the open-hearth furnaces of outside plants to supply them with steel bricks, must, as soon as possible, produce their own steel bricks in their own converters.

2) Those plants that have steel-wire cable and pre-stressing equipment, but rely on the open-hearth furnaces of outside plants to supply them with steel materials, must, as soon as possible, produce their own steel materials in their own converters.

3) Those plants that have large and medium-sized rolling mills, must enlarge the sphere of their converter steel production by producing steel materials that are needed by industries, such as: heavy rails, medium rails, and large and medium steel blocks. Moreover they should try to produce steel materials for bridge construction, and not only small steel material.

4) Those plants that have medium and thin plate rolling mills must use their converters to produce steel materials for the production of medium and thin steel plates, and moreover, try to produce shipbuilding and boiler plates. At present, there is an urgent demand for steel to make electrical machinery. It is easy to meet this demand with converter steel. Those plants

that have thin plate rolling mills should use their converters to produce industrial pure iron and silicon steel for electrical machinery and compressed utensils.

5) In order to save iron alloy and raise the quality of steel, the plants, which are producing No. 0-4 steel by using 160 millimeter ingot molds should change and produce blister steel.

6) There is a great demand throughout the country for electric welding rails and light rails at present. Converters can produce them easily. The key enterprises in the various provinces and cities should produce them in great quantities.

7) In order to save steel materials, the key enterprises in the various provinces and cities must produce and encourage the consumer industries to use the alloy and high strength steel. Furthermore, the enterprises should gauge their production to meet demands and practical use and should produce a portion of the supply of No. 5 steel to take the place of No. 3 steel.

8) Coordinate local demands with equipment condition. When the converters are producing separately, they should produce some superior quality carbon steel and alloy compound steel. When the converter and electric furnace are combined, they should produce various types of alloy steel.

B. In addition to satisfying current needs, there should also be an attempt to produce steel to meet future demands, especially those that require higher quality carbon steel and alloy steel. The policy is to develop from lower grade to higher grade steel, so that the goal can be fulfilled step by step.

For the side-blown basic converter to attain high quality, many varieties, surpass open-hearth furnaces, and catch up with electric furnaces, it must first solve all current problems. At the present, there are many difficulties concerning quality and variety. These difficulties are:

1) The increase in varieties should not correspond to the increase in quantity. Side-blown basic converter steel production increases very rapidly, but most of its products are No. 2-5 carbon steel. At present, there are more than 100 varieties of steel produced or in the trial stage of production, but only 30 varieties

are being used by industries. All the varieties that are now in the trial stage of production have not been tested for their mechanical properties and have not been tried by the consumers. There are fewer converter steel varieties than there are open-hearth furnace steel and electric furnace steel varieties. Open-hearth furnaces are now producing and trial-producing over 200 varieties of steel, while electric furnaces over 600 varieties. As for alloy compound steel, open-hearth furnaces are already producing 72 numbers of steel, while converters produce only 18 numbers, most of whose mechanical properties have not been thoroughly tested. A comparison is made in the following chart:

	Open-Hearth Steel Varieties	Converter Steel Varieties
Carbon Steel	40	30
High Quality Carbon Steel	69	50
Silicon Steel	8	10
Spring Steel	4	2
Low Alloy High Strength Steel	6	7
Alloy Compound Steel	72	18
Bearing Steel	3	-
Alloy Tool Steel	5	-
TOTAL	207	117

Note: The figures for open-hearth furnaces are those given at the beginning of the year, while the figures for converter steel are those given at the Converter Steel Production Conference, held in T'ang-shan in March 1960.

2) Variety and production in the various areas is not balanced. In China, only Liaoning Province and seven other provinces (cities) have open-hearth furnaces, while all the other provinces have only converters. But, the movement to enlarge the varieties of converter steel is not evenly promoted in the various areas of the country this year. With the exception of the Shanghai, T'ang-shan, and Tientsin old converters and several new plants which are producing relatively more varieties, all the

other plants in the other provinces and cities are producing only the No. 4 common carbon steel.

3) In some plants, quality must be further developed. Because of the back-blown method, low steel temperature, bad deoxidization, and inferior quenching method, the steel from these plants contains more non-metallic impurities than open-hearth furnace steel does. It is of the Grade 4-5 quality.

Of those steel varieties that have successfully passed their preliminary test, some have very low steel quality. Their composition is bad and they are improperly quenched. These production methods must be greatly improved. Because processing activities are not normal, steel quality and mechanical properties fluctuate greatly and are not steady. For instance, the nitrogen content, when the steel is properly blown, may reach 0.004%, but when it is improperly blown, the percentage of nitrogen is higher; individually, some are as high as 0.013%. This greatly effects the steel's mechanical properties.

Because of these factors, there must be a continuous effort to surpass open-hearth furnaces and catch up with electric furnaces.

500/300 ROLLING MILLS PRODUCE 24 KILOGRAM MEDIUM RAILS

[Following is a translation of an extract from an article by the Ho-fei Special Steel Plant, Kang-t'ieh (Steel), Peiping, No. 10, 27 May 1960, page 597.]

I. A Simple Explanation of the Main Equipment in the Mill

The principal equipment of the 500/300 steel rolling is:

(1) Nominal diameter 500 millimeters, roller length 1,500 millimeters, two three-high mills;

(2) Power 1,000 kilowatts, rotation rate 590 revolutions per minute, mechanical advantage ratio 5.9, one principal motor;

(3) Cutting power 150 tons, light to 10 cuttings per minute, one hot-cutting machine;

(4) Nominal diameter 300 millimeters, roller length 750 and 600 millimeters, five three-high mills;

(5) Power 1,000 kilowatts, rotation rate 590 revolutions per minute, mechanical advantage ratio two, one principal motor;

(6) 50 ton up-and-down, actual cutting per minute 10 to 12 times, one cold-cutting machine.

II. The Technical Process of Rolling 24-Kilogram Medium Rails

To produce a 24-kilogram medium rail from a six inch steel ingot, the rail must be reheated once and pass through a nominal diameter 500mm rolling mill 11 times Finally, the rail goes from the 500 rolling mill to the

300 rolling mill as a finished product, from which it is then brought to the cooling table, where grooves are made and it is straightened. The rail passes through the first mill six times and through the second mill five times. Grooves are made by a combined box-shape, hat-shape, and reclining-shape system. In this system, there are two box-shapes, three hat-shapes, and six reclining-shapes.

III. Groove Planning for 24 Kilogram Medium Rails

24-kilogram medium rails use six inch steel ingots as raw material. At present, the quality of the rails, the constant shape of the grooves, and dispersion in the rolling process are all quite satisfactory.

STRENGTHEN THE SEMI-HEAT-TREATMENT TRANSFORMATION OF 40Mn18Cr3 STEEL*

[Following is a translation of an extract from an article written by Sun Chen-pao, Steel Research Institute, Ministry of Metallurgical Industry, Kang-t'ieh (Steel), Peiping, No. 10, 27 May 1960, pp 600.]

40Mn18Cr3 steel is an imitation of a German [GDR] steel which is type 40MnCr72. It is used to manufacture a non-nickel and non-magnetic steel plate, which is to be made into a protective ring for steamship generators. Because the protective ring must have a relatively high degree of hardness, and because this variety of steel cannot be hardened by the heat-treatment method, it must be re-processed by the transformation-strengthening method to riase its degree of hardness. At first, when the plants were using this variety of steel to manufacture the protective rings, the technical operation was too complicated, and so, the manufacturing process met with a series of difficulties. One of the main difficulties was that it did not meet the requirement in its degree of hardness.

On the one hand, careful observation was made of the technical operation of production, this was followed by analysis and research to find the difficulties,

*Those who participated in the experiment described in this article are: from the Steel Research Institute, Feng Chung, Yen Chen-ch'iu, Li Yu-ch'in, and Yu Mou-te; from the central laboratory of a certain steel plant, Wang Chung-hsin, Wang Fu-chih, Sung Li-p'ing, and Ch'eng Tso-ch'en.

and finally the problems were discussed with the workers to find solutions for them; on the other hand, experiments were made in laboratories to understand the laws that effect production, and to prove and apply the laws in production. Thus, the finished products were soon able to meet the required standards and reach the level of advanced countries.

NEW ITEMS

[Following are translations of extracts from new items published in Kang-t'ieh (Steel), Peiping, No. 10, 27 May 1960, page 620.]

The Ho-fei Heat-resistant Materials Plant, after having successfully created silicon bricks, has finally succeeded in manufacturing light silicon bricks, which are of good quality, according to their preliminary tests. Their physical and chemical properties have reached the advanced international level: for instance, voids 56% of the total volume, density 1.013 gram/cubic centimeter, ultimate compressive strength 44 kilogram/square centimeter, and melting point 1680°C.

* * *

Recently, the Canton Pa-i Steel Plant used anthracite coal instead of coke to make white marble and the result is satisfactory. The efficiency rate is 98% and the finished product is first grade material. The furnace conditions are normal without any blocking. The success of the experiment not only reduces production cost but also saves a great quantity of coke.

* * *

The Peiping Special Steel Plant has used wholly or mostly baked anthracite coal in the place of coke in its furnaces for melting iron. The experiment is a success.

This experiment saves a great quantity of coke and has improved the melting process. According to statistics when 50% of the fuel is baked anthracite coal, the average rise in the temperature of melted iron is 30-50°C. Compared to the iron temperature when coke was used, its melting rate is 20% to 30% higher.

* * *

All the personnel of Rolling Mill No. 1 in the steel plant of the Ma-an-shan steel and Iron Works Company have made a reform by successfully producing No. 6 steel with a 250mmX5 small rolling mill.

* * *

With the hope of attaining rapid development in China's stainless and heat-resistant steel production and to summarize and exchange production experiences and research achievements, the Ministry of Metallurgical Industry sponsored the First National Stainless and Heat-Resistant Steel Production Conference, at the Ta-yeh Steel Plant between 15 and 20 April 1960.

At the meeting, it was pointed out that within yhe last several years, especially since the great leap forward movement, stainless and heat-resistant steel production and its research activities have made great achievement. For instance, the recent success in creating the series of Cr-Mn-N, Fe-Cr-Al, Fe-Al-Mo stainless and heat-resistant steel, have now been put into industrial production.

At the meeting, Hsiao Ming-wei, a division head in the Ministry of Metallurgical Industry, first made a report on the promotion of stainless and heat-resistant steel production in China.

During the conference, Russian experts and delegates from various steel plants presented more than 20 special problem reports, 22 summaries and exchanges of great scientific techniques and production experiences; an outline for the basic technical operation of stainless steel production was drafted; and 16 important research problems were planned.

With the hope of achieving the above-mentioned production and research tasks, all participating units signed a cooperative contract, aiming at mutual assistance and accomplishment of common objectives.

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